

MIL-C-3316

25 OCTOBER 1950

SUPERSEDING

Navy 52C23a

15 November 1945

MILITARY SPECIFICATION

CEMENT, ADHESIVE FOR THERMAL INSULATION

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.

1. SCOPE

1.1 Scope.—This specification covers adhesive cement for securing thermal insulation to ships hulls and ventilation ducts, fibrous glass tape to joints of hull insulation, and securing lagging cloth to insulation on piping and machinery.

1.2 Classification.—Adhesive cement shall be of the following types, as specified (see 6.1):

Type I.—A cement for securing cork and fibrous glass insulation board to metal surfaces and for sealing the edges of fibrous glass insulation board.

Type II.—A cement for securing glass tape to fibrous glass insulation board and securing lagging to thermal insulation of piping and machinery.

Type III.—A cement for securing bonded fibrous glass insulation to metal surfaces.

2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 Specifications.—The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

FEDERAL SPECIFICATIONS

HH-C-561 —Cork; Compressed (Cork-board) (For Thermal Insulation).

NN-B-621 —Boxes, Wood, Nailed and Lock-Corner.

NN-B-631 —Boxes, Wood, Wire-Bound, for Domestic Shipment.

RR-C-96 —Cans, Steel, (Tinned-Plate, Terne-Plate, and Black Sheet); Friction-Covers.

SS-C-466 —Cloth, Yarn, Thread, and Tape; Asbestos.

TT-P-141 —Paint, Varnish, Lacquer, and Related Materials: Methods of Inspection, Sampling and Testing.

VV-L-791—Lubricants, Liquid Fuels, and Related Products: Methods of Inspection, Sampling and Testing.

LLL-B-631—Boxes, Fiber, Corrugated (For Domestic Shipment).

LLL-B-636—Boxes, Fiber, Solid (For Domestic Shipment).

MILITARY SPECIFICATIONS

JAN-P-106—Packaging and Packing for Overseas Shipment — Boxes; Wood, Nailed.

JAN-B-107—Boxes; Wood, Wirebound (Overseas Type).

JAN-P-109—Packaging and Packing for Overseas Shipment — Barrels, Tight.

JAN-P-702—Paint, Inside, White, Semi-Gloss, Fire-Retardant.

JAN-G-742—Glass, Fibrous: Board and Stripping Tape, Hard-Surface (Heat Insulation).

U. S. ARMY SPECIFICATION

100-2 —Standard Specifications for Marking Shipments by Contractors.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material.

32G5 —Glass, Fibrous (Duct Insulation).

32G6 —Glass, Fibrous: Board and Stripping Tape (Heat Insulation).

32G9 —Glass, Fibrous: Cloth, Tape, and Thread (For Lagging Insulation).

(*Army.*—Copies of specifications should be obtained from the procuring agency or as directed by that agency. Both the title and identifying number or symbol should be stipulated when requesting copies.)

(*Navy.*—Copies of Federal, Military and Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that activities of the Armed Forces should make application to the Commanding Officer, Naval Supply Center, Norfolk 11, Va. Both the title and identifying number or symbol should be stipulated when requesting copies.)

2.2 Other publications. — The following publications of the issue in effect on date of invitation for bids, form a part of this specification:

BUREAU OF SUPPLIES AND ACCOUNTS PUBLICATION

Navy Shipment Marking Handbook.

(Copies of the Navy Shipment Marking Handbook should be obtained from sources given for obtaining specifications for the Navy.)

INTERSTATE COMMERCE COMMISSION REGULATIONS

Regulations for Transportation of Explosives and Other Dangerous Articles, etc.

(Information as to the availability of Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles, etc., may be obtained from the Interstate Commerce Commission, Washington 25, D. C.)

3. REQUIREMENTS

3.1 Qualification. — Adhesive cement for

thermal insulation shall be of a brand which has been tested and successfully passed the qualification tests specified in section 4 (see 6.2).

3.2 Material.—Cement, in the condition in which delivered, shall be suitable and effective for the purpose intended without heating or addition of other ingredients, and shall be free from grit, lumps, and skins, and shall not gel, liver, settle hard or otherwise deteriorate when stored for a period of one year in airtight containers. Cement shall not contain any mineral salts, or other materials that would injuriously affect the insulation or glass cloth.

3.3 Flash point.—The flash point of the cement shall be not less than 80° F., when tested by the method prescribed in 4.5.2.

3.4 Fire resistance.—When tested as described in 4.5.3, there shall be no residual flame or continuous burning of any specimen after removal of the test flame.

3.5 Type I.

3.5.1 Adhesive cement shall be suitable for securing compressed cork conforming to Specification HH-C-561, fibrous glass insulation board conforming to Specifications 32G6 and JAN-G-742 to bare steel surfaces.

3.5.2 Protection against corrosion. — Cement shall protect bare steel from corrosion when tested as described in 4.5.4.

3.5.3 Consistency.—The consistency of the cement shall be such as to allow a cone penetration average of not less than 25 nor more than 35 mm, when tested as described in 4.5.5.

3.5.4 Adhesive strength.

3.5.4.1 The average adhesive strength shall be as follows:

- a. Specimens referred to in 4.5.6.1.2.1 after drying as described in 4.5.6.1.1, not less than 125 pounds.

- b. Specimens referred to in 4.5.6.1.2.2 after drying as described in 4.5.6.1.1, not less than 100 pounds.
- c. Specimens referred to in 4.5.6.1.2.3 after drying as described in 4.5.6.1.1, not less than 50 pounds.

3.5.4.2 Cement shall be considered as conforming to the strength requirements specified in 3.5.4.1 when failure occurs in the cork-board at a strength lower than that specified for the adhesive.

3.5.5 Flexibility.—Cement shall not chip, scale, or otherwise leave the surface of the tin strip when subjected to the tests described in 4.5.7.

3.5.6 Fire resistance.—Cement shall not burn during the test, and shall not smolder or lose its adhesiveness after subjection to the test described in 4.5.8.

3.6 Type II.

3.6.1 Cement shall be suitable for securing glass stripping tape (Spec. JAN-G-742) to fibrous glass insulation board, and securing glass lagging cloth and tape (Spec. 32G9), and asbestos cloth and tape (Spec. SS-C-466) to thermal insulation of piping and machinery.

3.6.2 Flexibility.—Cement shall not chip, scale or otherwise leave the surface of the tin strip when subjected to the test described in 4.5.7.

3.6.3 Viscosity. — The viscosity of the cement at 77° F. shall be not less than 90 nor more than 110 Krebs units, when tested by the method prescribed in 4.5.9.

3.6.4 Adhesive strength. — The adhesive strength before and after aging shall be such that a specimen will support a 2,000-gm weight for a period of 10 minutes when tested as described in 4.5.6.2.2.

3.6.5 Discoloration or bleeding.—Cement shall not cause discoloration or bleeding through glass tape painted with two coats of fire-retardant paint for hull insulation, and one coat for piping and machinery conforming to Specification JAN-P-702.

3.7 Type III.

3.7.1 Cement shall be suitable for securing bonded fibrous glass insulation conforming to Specification 32G5 to metal surfaces.

3.7.2 Flexibility.—Cement shall not chip, scale or otherwise leave the surface of the tin strip when subjected to the test described in 4.5.7.

3.7.3 Protection against corrosion.—Cement shall protect bare steel from corrosion when tested as described in 4.5.4.

3.7.4 Viscosity. — The viscosity of the cement at 77° F. shall be not less than 115 nor more than 130 Krebs units, when tested as described in 4.5.9.

3.7.5 Adhesive strength. — The adhesive strength before and after aging shall be such that a specimen will support a 2,000 gm weight for a period of 10 minutes when tested as described in 4.5.6.

3.8 Workmanship.—The materials shall be free from all ingredients which may affect the serviceability or have a deleterious effect on the metal or insulation to which the material is applied. The materials shall be free from chlorinated solvents, benzol, or any other toxic ingredients which would adversely affect the health of workmen using them.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Inspection procedures.—For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

4.2 Qualification tests at a Government laboratory.—Qualification tests shall be conducted at the Engineering Experiment Station, Annapolis, Md. These tests shall consist of the tests specified in 4.5. After necessary arrangements have been made, as outlined in 6.2.

4.3 Sampling.—Each case or large container shall be carefully identified by manufacturer's batch (or control lot) number, until ultimate action is taken as to acceptance or rejection of material offered for delivery. Individual samples shall not be mixed, shall be placed in separate airtight and watertight containers, which shall be nearly filled, covered and sealed to prevent atmospheric effects, and shall be labeled completely with information on the lot and batch number, date of sampling, contract number, and applicable specification.

4.3.1 Sampling lot.—For purposes of sampling, a lot shall consist of all material prepared from one manufactured batch in a single production and offered for delivery at one time.

4.3.2 Sampling procedure for lot acceptance tests.—From each lot the Government inspector shall select a representative 1 quart sample for the tests specified in 4.4.1.

4.3.3 Sampling procedure for production check tests.—In addition to the samples selected for lot acceptance tests, the Government inspector shall select three representative 1 quart samples from the first lot offered for delivery, and thereafter from any lot in each group of 10 successive lots. The material shall be placed in clean, dry containers which shall be tightly sealed and carefully marked. One quart shall be forwarded to Engineering Experiment Station, Annapolis, Md. for the tests specified in 4.4.2, 1-quart shall be delivered to the contractor, and 1-quart shall be held by the Government inspector for retests in case of dispute.

4.4 Inspection tests.

4.4.1 Lot acceptance tests.—The samples selected in accordance with 4.3.2 shall be subjected to those tests which will establish the identity of the inspection sample with that given qualification (according to appropriate data to be furnished by Bureau of Ships) and to tests given in 4.5.2, 4.5.5, 4.5.6 and 4.5.9. In addition, each selected container of packaged material and its contents shall be examined by the Government inspector to determine compliance with container, marking, and other requirements of this specification which do not require tests.

4.4.1.1 Place of test.—Unless otherwise specified, lot acceptance tests shall be conducted at the contractor's plant, by the contractor. In the presence and under the supervision of the Government inspector. Contractors shall provide the necessary laboratory facilities satisfactory to the inspector, or shall engage the services of a commercial testing laboratory acceptable to the inspector.

4.4.1.2 Action in case of failure.—If any one of the samples tested is found to be not in conformance with the specification, the lot which it represents shall be rejected. A rejected lot may be resubmitted for Government inspection only after the manufacturer, after being informed of the reasons for rejection, has so reworked the entire lot as to remove or correct all nonconforming material.

4.4.2 Production check tests (at a government laboratory).—The samples selected in accordance with 4.3.3 shall be subjected to the tests described in 4.5.

4.4.2.1 Place of tests.—Unless otherwise specified, production check tests shall be conducted at Engineering Experiment Station, Annapolis, Md.

4.4.2.2 Action in case of failure.—Acceptance of the first lot offered for delivery shall be withheld until a satisfactory report is re-

ceived on the production check test sample. Unless otherwise specified, acceptance and rejection of lots shall normally be on the basis of the sampling and inspection specified in 4.3.2 and 4.4.1, and acceptance shall not be withheld pending receipt of test reports on production check test samples. However, upon receipt of an unsatisfactory test report on a production check test sample, the Government inspector shall select additional samples from every subsequent lot offered for delivery. The samples so selected shall be submitted to Engineering Experiment Station, Annapolis, Md., and shall there be subjected to test or tests wherein failure was observed. Lots shall then be accepted only upon receipt of a satisfactory test report on the samples so selected. Additional testing shall be discontinued and lot acceptance returned to the normal basis when three successive lots have been accepted.

4.5 Methods of tests.

4.5.1 Stability.—The cement shall be subjected to a temperature of 16° F. for 16 hours for stability before testing.

4.5.2 Flash point.—The flash point shall be determined in accordance with method 110.3 of Specification VV-L-791.

4.5.3 Fire test.—A strip of fiber glass tape 6 inches long, 1½ inches wide, and 0.005 inch thick shall be given a thin coat of cement and then dried in an electrically heated oven for 20 hours at 220° F. Remove the specimen, suspend vertically from a clamp covering the upper ½ inch of the length. Place a Bunsen burner 1 inch below the specimen in such a position that ½ inch of the specimen is in the burner flame. Remove the burner at the end of 5 seconds and note the length of time that the coating burns.

4.5.4 Protection against corrosion. — Ground steel strips ¼ by 1 by 6 inches shall be dipped in the cement and allowed to dry for 24 hours. At the end of this time the strips shall be subjected to a 4-percent salt

solution spray for 72 hours at 100° F. The strips shall be removed from the spray and examined for penetration of the salt spray and corrosion of the metal surfaces.

4.5.5 Consistency.—The consistency shall be determined as follows:

4.5.5.1 Apparatus.—The apparatus used shall be as specified in method 31.1 of Specification VV-L-791, except that the total weight of the cone and rod shall be 75 gm.

4.5.5.2 Procedure.—The open cup portion of the grease worker (see method 3.1.1 of Spec. VV-L-791) shall be completely filled with the well-mixed sample at a temperature of 77° ± 1° F. A straight edge shall be drawn across the surface of the sample to remove any excess material and to present a smooth surface. The apparatus shall be leveled and the plunger lowered until the tip of the penetrometer cone just touches the surface of the sample. The scale shall then be adjusted so that the scale actuating device is in contact with the top of the rod holding the penetrometer cone and the scale reading recorded. The plunger shall be released suddenly and kept released for 5 seconds. The scale actuating device shall be moved until it is again in contact with the top of the rod holding the penetrometer cone, and the scale reading recorded. The penetration is the difference between the two readings. Five tests shall be made and the average reported. All tests shall be performed with sufficient rapidity to guard against nonuniformity due to evaporation or skinning. The sample shall be smoothed over before each test.

4.5.6 Adhesive strength.

4.5.6.1 Type I.

4.5.6.1.1 Preparation of samples. — Two steel disks 4 inches in diameter and ½ inch thick shall be drilled and tapped in the center to receive a ½-inch bolt. The tapped holes shall not be drilled entirely through the disks. Each bolt shall be drilled radially at the outer

MIL-C-3316

end to receive a swivel joint steel pin for securing to the testing machine. The cement shall be applied to the surface of the two steel disks and allowed to set for 5 minutes. The coated steel disks shall then be applied to the two surfaces of a 4-inch compressed cork disk, 1 inch thick, in such a manner that the cork disk will be sandwiched between the steel disks. Fifteen of these specimens shall be prepared and allowed to dry for 72 hours under a pressure of 2 p. s. i. at a temperature of 80° F.

4.5.6.1.2 Procedure.

4.5.6.1.2.1 Five of the specimens shall be pulled to rupture in a testing machine whose moving head travels at the rate of approximately 12 inches per minute.

4.5.6.1.2.2 Five of the specimens shall be submerged in salt water for 2 hours. Upon removal they shall immediately be pulled to rupture in a testing machine whose moving head travels at the rate of approximately 12 inches per minute.

4.5.6.1.2.3 The remaining five specimens shall be heated in an oven at 200° F. for 2 hours. Upon removal they shall be immediately pulled to rupture in a testing machine whose moving head travels at the rate of 12 inches per minute.

4.5.6.2 Type II.

4.5.6.2.1 *Preparation of samples.* — Six specimens of fibrous glass board 10 inches long by 3 inches wide by 1 inch thick, conforming to Specification 32G6, shall be coated on the glass cloth face with the cement and allowed to set for 10 minutes. Six strips of glass cloth tape 12 inches long by 1½ inches wide by 0.007 inch thick (Spec. JAN-G-742) shall then be applied to the coated glass board specimens and allowed to dry for 24 hours.

4.5.6.2.2 *Procedure before aging.* — Three of the specimens shall be supported in a horizontal position with tape side down, a 2,000

gm weight attached to the free end of the tape, and suspended for a period of 10 minutes.

4.5.6.2.3 *Procedure after aging.* — The remaining three specimens shall be aged at a temperature of 194° F. for 24 hours, prior to testing as described in 4.5.6.2.2.

4.5.6.3 Type III.

4.5.6.3.1 *Preparation of samples.* — Six bare steel plates, 10 inches long by 6 inches wide by ⅛ inch thick, shall be coated with the cement and allowed to set for 10 minutes. Six specimens of bonded fibrous glass insulation, 12 inches long by 3 inches wide by 1 inch thick, conforming to Specification 32G5, shall then be applied to the coated steel plates and allowed to dry for 24 hours.

4.5.6.3.2 *Procedure before aging.* — Three of the specimens shall be supported at each end in a horizontal position with bonded fibrous glass side down, a 2,000-gm weight attached to the free end of the insulation, and suspended for a period of 10 minutes.

4.5.6.3.3 *Procedure after aging.* — The remaining three specimens shall be aged at a temperature of 194° F. for 24 hours, prior to testing as described in 4.5.6.3.2.

4.5.7 *Flexibility.* — The flexibility shall be determined as follows:

4.5.7.1 *Apparatus.* — The apparatus shall consist of the following:

A panel 8 by 18 inches, 0.011 inch thick, made from bright tin-plate.

A film applicator with a clearance of 0.02 inch, and a gap of sufficient size to make a film 3 to 6 inches wide.

A steel mandrel ¼ inch in diameter and 6 inches long supported at each end.

4.5.7.2 *Procedure.* — Place the 8 by 18-inch tin panel on a flat surface and draw down a film 18 inches long and 3 to 6 inches wide

MIL-C-3316

terior of the can, with the exception of the friction ring, shall be protected from corrosion by the application of suitable corrosion-resistant enamel, and when tin content of solder is less than 30 percent side seams shall be stripped.

5.1.2.2 Five-gallon lug-cover steel pails, fiber drums, and tight barrels shall conform to 5.1.1.2, 5.1.1.3 and 5.1.1.4, respectively.

5.2 Packing.

5.2.1 For domestic shipment.

5.2.1.1 Four 1-gallon cans shall be packed in a nailed wood box or wire-bound wood box conforming to Specifications NN-B-621 and NN-B-631, respectively, or in a style RSC corrugated fiber box or solid fiber box conforming to Specifications LLL-B-631 and LLL-B-636, respectively, having a minimum Mullen test of 275 pounds. No strapping will be required.

5.2.1.2 Five-gallon lug-cover steel pails, fiber drums, or tight barrels will require no packing.

5.2.2 For overseas shipment.

5.2.2.1 Four 1-gallon cans shall be packed in a nailed wood or wirebound box conforming to Specifications JAN-P-106 and JAN-B-107, respectively.

5.2.2.2 Five-gallon lug-cover steel pails, fiber drums, or tight barrels will require no packing.

5.3 Marking.—In addition to any special marking required by the contract or order, shipments for the Army shall be marked in accordance with Specification 100-2; for the Navy in accordance with the Navy Shipment Marking Handbook.

6. NOTES

6.1 Ordering data. — Procurement docu-

ments should specify the following:

- a. Title, number, and date of this specification.
- b. Type required (see 1.2).
- c. Size of container required (see 5.1.1 and 5.1.2).
- d. Whether the subject commodity is to be prepared for domestic or overseas shipment (see sec. 5).

6.2 In the procurement of products requiring qualification the right is reserved to reject bids on products that have not been subjected to the required tests and found satisfactory for inclusion on the Army-Navy-Air Force Qualified Products List. The attention of suppliers is called to this requirement, and manufacturers are urged to communicate with the Bureau of Ships, Navy Department, Washington 25, D.C., and arrange to have the products that they propose to offer to the Army, the Navy or the Air Force, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Chief of the Bureau of Ships, Navy Department, Washington 25, D.C.

Notice.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

Navy—Bureau of Ships

Other interest:

Army—ST
Navy—OSY.